PB-218 293

WATER SUPPLY AND WATER QUALITY CONTROL STUDY, AZTEC RESERVOIR, SANTA FE RIVER, NEW MEXICO. STUDY OF NEEDS AND VALUE OF STORAGE FOR MUNICIPAL AND INDUSTRIAL WATER SUPPLY AND WATER QUALITY CONTROL

Public Health Service
Dallas, Texas

May 1965

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WATER SUPPLY AND WATER QUALITY CONTROL STUDY AZTEC RESERVOIR SANTA FE RIVER, NEW MEXICO

Study of Needs and Value of Storage for Municipal and Industrial Water Supply and Water Quality Control

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region VII
Dallas, Texas

MAY 1968

WATER SUPPLY

AND

WATER QUALITY CONTROL STUDY

AZTEC RESERVOIR

SANTA FE RIVER, NEW MEXICO

Abstract

A survey has been made which discloses a future need for municipal and industrial water supplies in the city of Santa Fe, New Mexico. There is no foreseeable need for water to control quality in the Santa Fe River. These conclusions are based on results of economic and demographic studies.

Prepared for

DEPARTMENT OF THE ARMY

U.S. Army Engineer District

Albuquerque, New Mexico

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, Region VII
Dallas, Texas

MAY 1965

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I. INTRODUCTION

Authority

In a letter dated February 3, 1965, the U.S. Army Engineer District, Albuquerque, New Mexico, requested that the Public Health Service investigate and prepare reports concerning the need for and value of storage for municipal, industrial, and water quality control purposes in the Santa Fe River basin, New Mexico.

This study has been done in accordance with (1) a Memorandum of Agreement between the Department of the Army and the Department of Health, Education, and Welfare, dated November 4, 1958 relative to Title III of the Water Supply Act of 1958 as amended; and (2) the Federal Water Pollution Control Act as amended (33 U.S.C. 466 et seq.).

Purpose and Scope

The purpose of this study is to determine the need for and value of storage for water requirements to the year 2070 for municipal, industrial, and water quality control purposes in the Santa Fe River basin, which is encompassed primarily by Santa Fe County, New Mexico.

Acknowledgments

Appreciation is expressed to the following organizations who gave counsel and technical advice during the study.

U.S. Army Engineer District, Albuquerque, New Mexico
City of Santa Fe, New Mexico
Chamber of Commerce, Santa Fe, New Mexico
New Mexico Department of Public Health, Santa Fe, New Mexico
Public Service Company of New Mexico, Santa Fe, New Mexico

II. SUMMARY OF FINDINGS AND CONCLUSIONS

Summary of Findings

1. The Corps of Engineers, Albuquerque, New Mexico, is making an investigation to determine the feasibility of constructing Aztec Reservoir, a multipurpose structure on the Santa Fe River about 3 miles northeast of the city of Santa Fe, New Mexico.

2. The study area consists of Santa Fe County. The Santa Fe River watershed is located in north-central New Mexico and is almost encompassed by Santa Fe County.

3. Santa Fe County had a total 1960 population of 44,970. The city of Santa Fe, with 34,676 persons, accounted for all of the urban population.

4. There are no heavy water-using industries in the study area; the water demand is therefore primarily municipal with small service industry use. In 1960, 33,600 persons were served an average of 3.46 million gallons per day (mgd) with a per capita use of 103 gallons daily. Santa Fe obtains water from McClure, Nichols, and Twomile Reservoirs, having a total yield of 2.2 mgd, and 6 wells yielding 6.1 mgd.

5. Following secondary treatment which removes about 87 percent of the biochemical oxygen demand (BOD), the sewage from the city of Santa Fe, amounting to about 2.5 mgd in 1960, is used for irrigation. There are no significant industrial waste discharges in the area.

6. Surface waters in the study area are of exceptional quality. Ground waters are of good quality except for hardness in some areas.

Conclusions

1. The study area is expected to reach a total population of 124,000 in 2020 with a corresponding urban population of 114,000. In 2070, the total population is expected to reach 178,000 with 168,000 urban dwellers.

2. Projections to the year 2020 indicate a municipal water requirement of 13.7 mgd with this increasing to 20.2 mgd by the year 2070.

3. The use of treated sewage for irrigation and extreme losses in the Santa Fe River channel below the treatment plant negate the need for storage for water quality control in the foreseeable future.

4. The value of benefits attributable to storage for municipal water supplies, as determined by the cost of the most likely alternative to the project, amounts to $130,000 annually. The Aztec project will increase the city's water supply by 1.4 mgd.

5. With no foreseeable need for storage to control water quality, there is no benefit attributable to storage for this purpose.

III. PROJECT DESCRIPTION

Location

The proposed Aztec Dam will be located about 3 miles northeast of the city of Santa Fe, New Mexico, on the main stem of the Santa Fe River. As shown on figure III-1 (located following page X-1 of this report), the reservoir will inundate Nichols Reservoir, one of three water supply impoundments presently serving the city of Santa Fe.

Stream Characteristics

The Santa Fe River rises in northeast Santa Fe County and flows 45 miles in a west-southwest direction to enter the Rio Grande River about 30 miles north of Albuquerque, New Mexico. Streamflow records on the Santa Fe River at a gaging station located between McClure and Nichols Reservoirs show an average discharge of 8.5 cubic feet per second (cfs). 1/ Downstream from Santa Fe, the river bed spreads to form a wide, sandy arroyo. Many of the arroyos which are tributaries to the Santa Fe River, as well as the river itself, are subject to flash flooding following infrequent but intense rainstorms.

Water Quality

Water to be impounded in Aztec Reservoir is of very high quality with a dissolved solids concentration of less than 60 milligrams per liter (mg/l) and a total hardness about 30 mg/l. 2/ Existing water supply reservoirs are closed to the public, thereby minimizing the addition of pollution from human sources.

Pertinent Data

Aztec Reservoir would have a conservation storage of 13,054 acre-feet which includes the inundated Nichols Reservoir. In addition, 3,020 acre-feet would be required for flood control and sediment, thus bringing the entire capacity to 16,074 acre-feet. The project would increase the net yield of the reservoir system by 1,620 acre-feet yearly (1.4 mgd).

IV. STUDY AREA DESCRIPTION

Location and Boundaries

The study area is Santa Fe County located in north-central New Mexico. The Santa Fe River watershed lies almost entirely within the county. General features of the watershed are shown in figure III-1. The watershed is approximately 40 miles long and has a maximum width of 14 miles. It covers an area of 256 square miles.

Geography and Topography

The topography of this area is steep and rugged. From the crest of the mountains northeast of Santa Fe where the river is fed by surface runoff, springs, and snowmelt, the terrain falls rapidly to the mountain foothills where the city of Santa Fe is located.

West of Santa Fe the river becomes a wide sandy arroyo until it reaches the deep canyons which guide it almost to the Rio Grande.

Vegetation of the basin varies from heavy coverage by conifers in the upper basin to the sparsely covered semiarid low plains.

Climate

Temperatures in Santa Fe have an average high and low of 80° and 57° respectively in the summer, and an average high and low of 40° and 16° in the coldest winter months. The average of possible sunshine is 74 percent, and the mean monthly humidity varies from 47 to 66 percent. The average annual rainfall at Santa Fe is almost 14 inches annually.

Principal Communities and Industries

Santa Fe, the capital of New Mexico, is the county seat of Santa Fe County and accounts for all of the urban population in that county. In 1960 the city of Santa Fe had a population of 34,676 and the county's population was 44,970.

Manufacturing, agriculture, mining, and other industries do not play an important role in the economy of Santa Fe. Instead, extensive local, State, and Federal government activities, related service industries, and a large tourist trade account for the major economic base of the area.

V. WATER RESOURCES OF THE STUDY AREA

Quantity of Water Available

Surface Water

Santa Fe obtains its water supply from 3 reservoirs having a total capacity of about 4,130 acre-feet with a drainage basin of about 25 square miles. McClure and Nichols Reservoirs are on the main stem of the Santa Fe River and Twomile is an off channel storage reservoir. These reservoirs are shown on figure III-1.

The mean and median discharges of the Santa Fe River below McClure Reservoir between 1914 and 1951 were 6,706 and 5,800 acre-feet annually. The maximum potential yield of the Santa Fe stream system is 5,000 acre-feet annually (4.4 mgd) with an exceedence of about 98 percent, and the yield of the present reservoir system is about 2.2 mgd.

Ground Water

The city of Santa Fe has 6 wells, with 250-400 foot pumping levels, which have a total dependable yield of 4,250 gallons per minute (6.1 mgd). These wells are employed when surface supplies are inadequate to meet the demand. During the drought from 1951-1956, over 50 percent of the municipal supply of water was taken from these wells. However, surface water is preferred because it is softer and feeds into the system by gravity. In addition to these municipal wells, there are many private wells in the area.

The area west of the city of Santa Fe is underlain by aquifers capable of an annual yield of over 11,700 acre-feet (10.4 mgd). 2/

Quality of Water Available

Water quality samples taken by the U.S. Geological Survey 2/ indicate that the Santa Fe public supply from the Santa Fe River is of exceptional quality. The ground water supplies can be described as good except for total hardness in some areas. Presented in table V-1 is a summary of samples taken near the city of Santa Fe.

Table V-1

Water Quality of the Study Area

Item	Measurement (mg/l) Surface Supply	Ground Water
Dissolved Solids	49-58	127-460
Chlorides	1.6-1.7	2.0-44
Sulfates	4.9-6.3	3.5-160
Fluorides	0.1-0.2	0-.6
Total Hardness	30	16-292

Source: Geological Survey 2/

VI. THE ECONOMY

An economic study was made of the study area and the resulting projections of population and industrial growth serve as a basis for estimating future water use requirements and waste discharges.

Present

Economic Geography

The study area (Santa Fe County) is in the northern Rio Grande valley located in north-central New Mexico. Santa Fe accounts for all the urban population in Santa Fe County. The city of Santa Fe at an altitude of 7,000 feet is surrounded by mountain ranges with peaks rising to 13,300 feet. The climate of Santa Fe has attracted many people with respiratory illnesses.

Resources Within the Area

The climate of Santa Fe is instrumental in making Santa Fe one of the chief tourist-recreation areas in the State. In addition to the healthful climate, the city of Santa Fe, which was founded in 1610, is the oldest capital in the United States and is surrounded with items of historic interest. The surrounding mountains provide the area with considerable wintertime skiing. The area is served by one railroad, two bus lines, three airlines, nine motor freight lines, and four national highways.

Agriculture is limited because of insufficient rainfall with the majority of cultivated land being irrigated. In 1959, a total of 6,700 acres was irrigated in the study area. 3/ Mining activity is relatively limited, with most of the mining output being used for local construction projects.

Manufacturing

Manufacturing is relatively insignificant in the study area, with manufacturing employing less than 5 percent of the 1960 labor force. 4/ The manufacturing that does exist in the study area is mostly associated with products to serve the large tourist trade. No heavy water-using industries are located in the study area at the present time.

Other Industries in the Area

Over 25 percent of the 1960 labor force was employed by the several government establishments in the Santa Fe area. Government employment includes that in connection with the nearby atomic energy projects at Los Alamos and offices of the Federal, State, county, and city government.

Construction, government, and service industries are the most significant employers in the area. In 1960 these industries accounted for over 85 percent of the total labor force in the study area. 5/

The Future

Since there is no heavy water-using industry in the area at the present and no evidence to show the potential development of heavy water-using industry, projections of population are relied on as an indicator of future water use. Historic and projected populations for the study area and the city of Santa Fe to 2070 appear in table VI-1.

Table VI-1

Historic and Projected Population for the Study Area and City of Santa Fe 1930-2070

	Historic			Projected	
	Study Area	Santa Fe		Study Area	Santa Fe
1930	19,567	11,176	1980	64,000	54,000
1940	30,826	20,325	2000	90,000	80,000
1950	38,153	27,999	2020	124,000	114,000
1960	44,970	34,676	2070	178,000	168,000

Source: Historic, Bureau of Census 5/
Projected, Corps of Engineers 6/

VII. WATER REQUIREMENTS--MUNICIPAL AND INDUSTRIAL

Past and Present Water Use

Santa Fe receives its water from six wells and three reservoirs northeast of the city. During periods of low runoff it becomes necessary to augment surface supplies with ground water and in the drought years from 1951 to 1956, this augmentation amounted to over one-half of the water demand.

Water usage by the city of Santa Fe is shown in table VII-1 along with the daily per capita demand. These demands include service industries, since, as discussed in Chapter VI, there are no heavy industries in the community.

Table VII-1

Water Use
Santa Fe, New Mexico

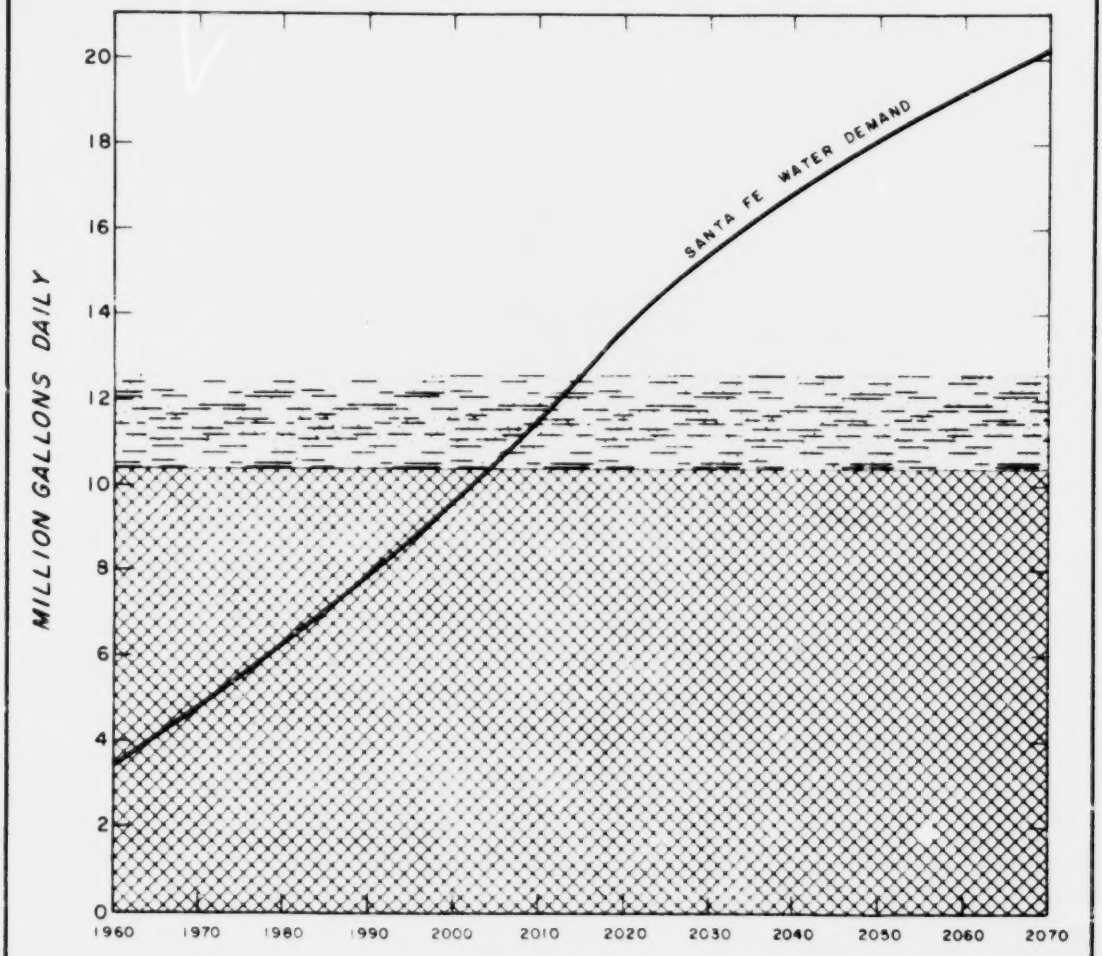
Year	Average Annual Use (million gallons daily)	Per Capita Demand (gallons per day)
1940	1.47	72
1950	2.72	97
1960	3.46	103

Future Requirements

Future water requirements for the city of Santa Fe are shown on figure VII-1 and are based on population projections presented in Chapter VI and a unit water use of 120 gallons per capita per day (gpcd). 7/ This rate of water use is intended to include both municipal and service industries and reflects the industrial character of Santa Fe with no large users of water at the present time or anticipated in the future.

The water requirements of Santa Fe are expected to be 13.7 mgd in 2020 and 20.2 mgd in the year 2070. Presently developed ground and surface water supplies are capable of supplying 8.3 mgd and will meet the city's needs until about 1993.

As shown on figure VII-1, the existing surface water supplies when combined with the maximum developed ground water sources will bring the available water resource for the city of Santa Fe to 12.6 mgd which would suffice without development of the Aztec site until about 2015. Without Aztec Reservoir, the demand would exceed the supply by 7.6 mgd in 2070. The development of Aztec Reservoir would only increase the available water resource by about 1.4 mgd and meet the city's requirements until about 2022.



LEGEND

AVAILABLE GROUND WATER SUPPLY

DEVELOPED SURFACE WATER SUPPLY

WATER SUPPLY & WATER QUALITY CONTROL STUDY
SANTA FE RIVER BASIN — NEW MEXICO

WATER DEMAND PROJECTIONS

SANTA FE, NEW MEXICO

U.S. DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
Public Health Service
REGION VII DALLAS, TEXAS

FIGURE VII-1.A

VIII. WATER QUALITY CONTROL

The quantity of water in the Santa Fe area is limited and because of this limitation, maximum use is made of available water. Effluent from the Santa Fe sewage treatment plant is moved in a closed conduit about 4 miles to the municipal golf course where about 100 acres of lawn and 400 acres of nearby feed crops are irrigated. This practice of using sewage plant effluent for irrigation is expected to continue in the future. For this reason, and because the sewage flow would be lost in the channel below Santa Fe if it were released, there is not expected to be a need for water for quality control by streamflow regulation in the foreseeable future.

IX. BENEFITS

Water Supply

The benefits of developing Aztec Reservoir result from the provision of an adequate, convenient, and dependable source of water supply. The value of those benefits is equivalent to the amount the water users would be willing to pay for these improvements in lieu of foregoing them.

In practice, a measure of the benefits can be approximated as the cost of achieving the same results by the most likely alternative means that would be utilized in the absence of the project.

There are two alternatives to the Aztec project available as a source of water supply for the city of Santa Fe. One is the construction of a single-purpose water supply reservoir at the proposed Aztec site and the other is the additional development of ground water potentials in the area.

The cost of a single-purpose reservoir at the Aztec site having an annual yield of 1.4 mgd is estimated to be $9,184,000, with an annual operation and maintenance cost of $33,000. This initial investment would cost the municipality $363,700 annually and would amount to 71 cents per thousand gallons of water. This annual cost was calculated by equating a municipally financed 4 percent, 50-year project to a Federally financed 3 1/8 percent, 100-year project.

It is probable, because of the high cost of developing the Aztec site, the municipality would first develop the available ground water in the area in absence of the Federally constructed project. Since the city is now paying 38 cents per thousand gallons of developed ground water, it is reasonable to assume that an additional 1.4 mgd could be developed for about the same unit cost or an annual cost of $194,000.

Since developing ground water resources is the most reasonable alternate to the Federally constructed project, the value of the benefits attributable to Aztec Reservoir for municipal and industrial purposes must be equated to the cost of ground water development.

The sequence of building Aztec Reservoir would necessarily begin about 10 years before the time of first need which would allow for planning and construction and would protect against annual fluctuations of water demand. Since the time of first need has been determined to be about 1993, it is necessary to discount the benefits from 10 years before that date, or 1983, to the base year of 1970. In this case, the benefit of $194,000 annually is reduced to a present worth of $130,000 annually at a 3 1/8 percent rate of interest.

The value of benefits for storage in Aztec Reservoir to yield 1.4 mgd for municipal and industrial purposes would be $130,000 annually.

Water Quality Control

Since there will be no foreseeable need for storage to control water quality, as discussed in Chapter VIII, there will be no benefits attributable to this purpose.

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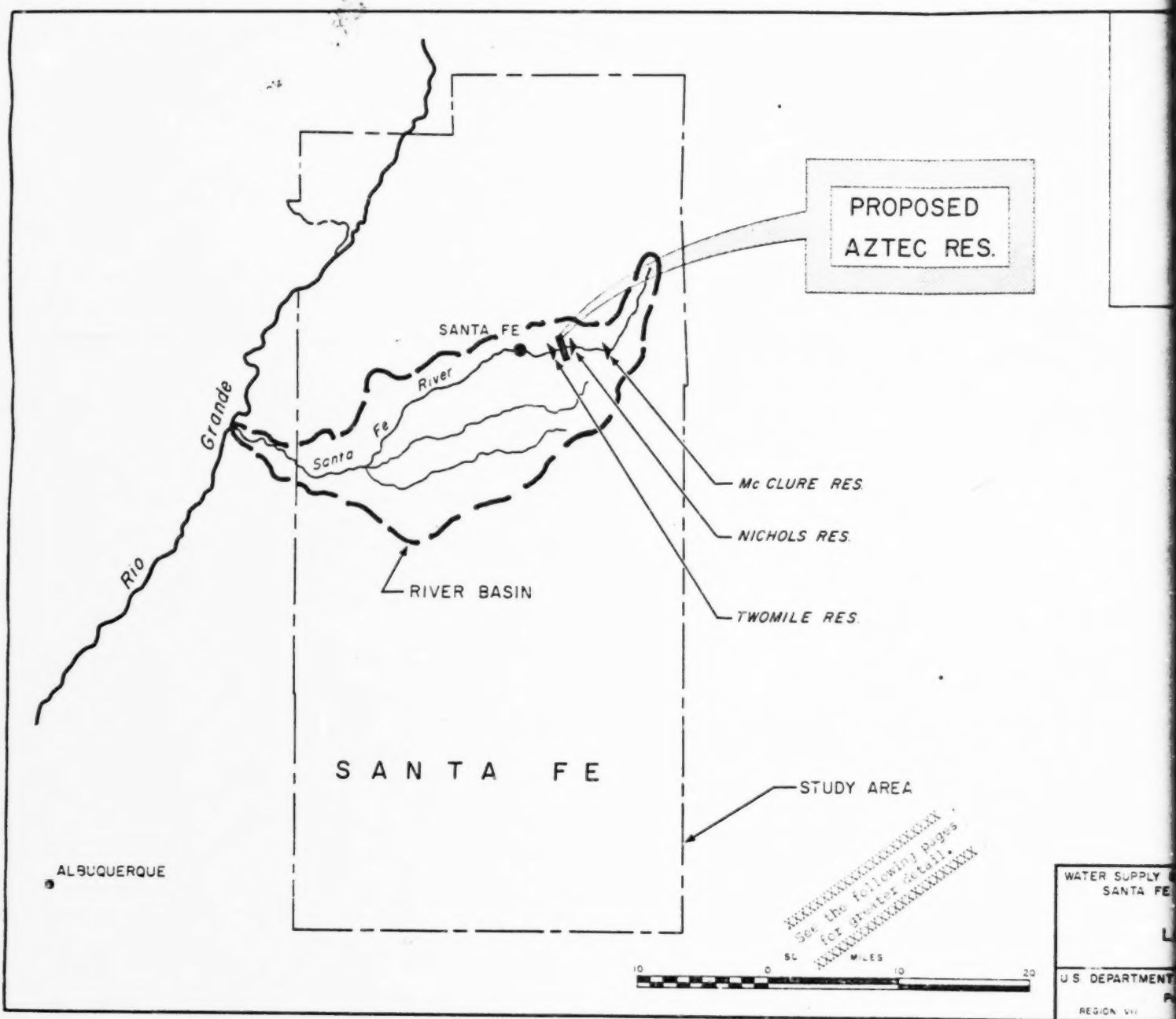
PROPOSED
AZTEC RES.
SANTA FE
Rio Grande
Santa Fe River
Mc CLURE RES.
NICHOLS RES.
TWOMILE RES.
RIVER BASIN
SANTA FE
STUDY AREA
ALBUQUERQUE
See the following pages
for greater detail.
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MILES
WATER SUPPLY
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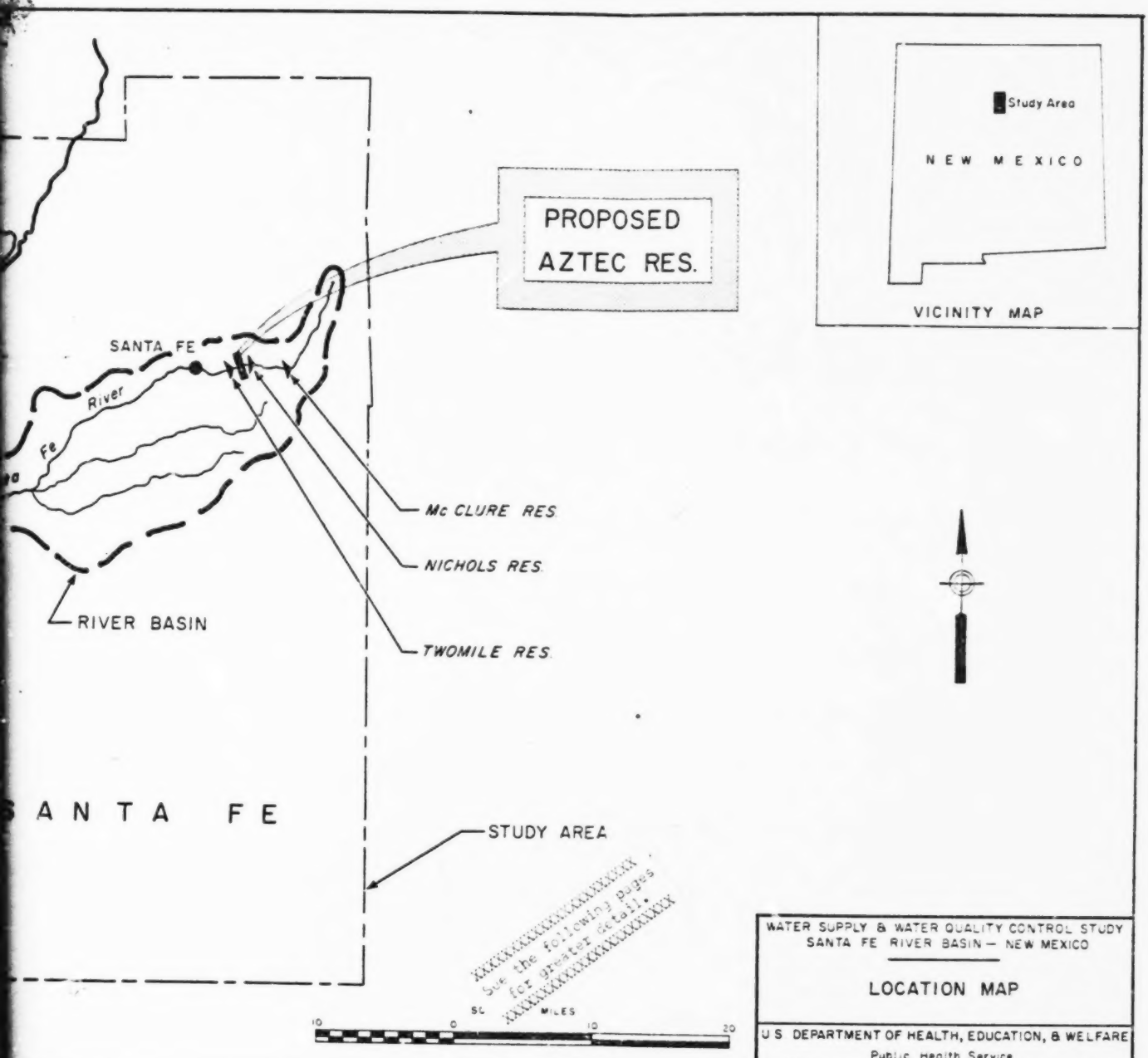

WATER SUPPLY & WATER QUALITY CONTROL STUDY
SANTA FE RIVER BASIN — NEW MEXICO

LOCATION MAP

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Public Health Service
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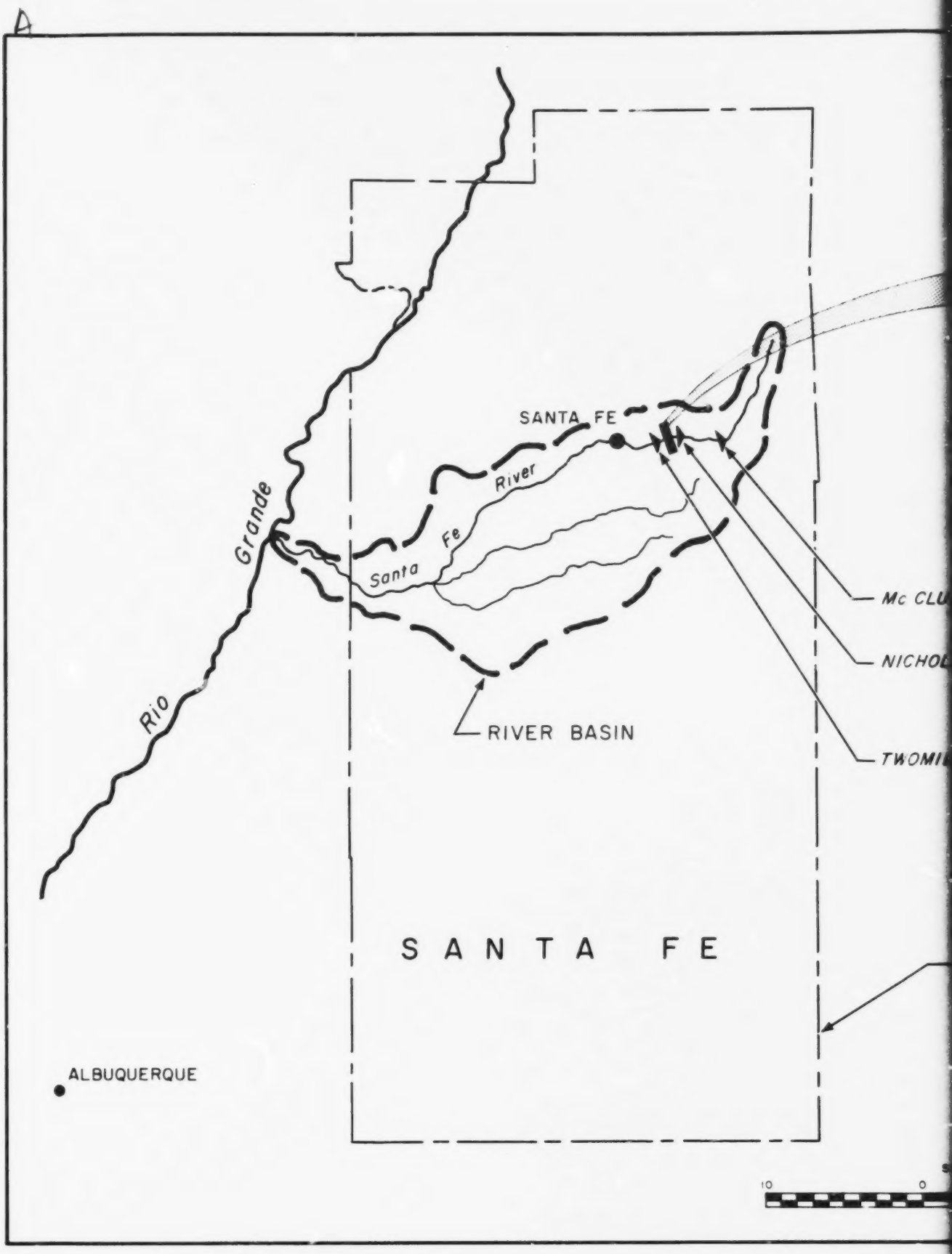
X-2

FIGURE III-1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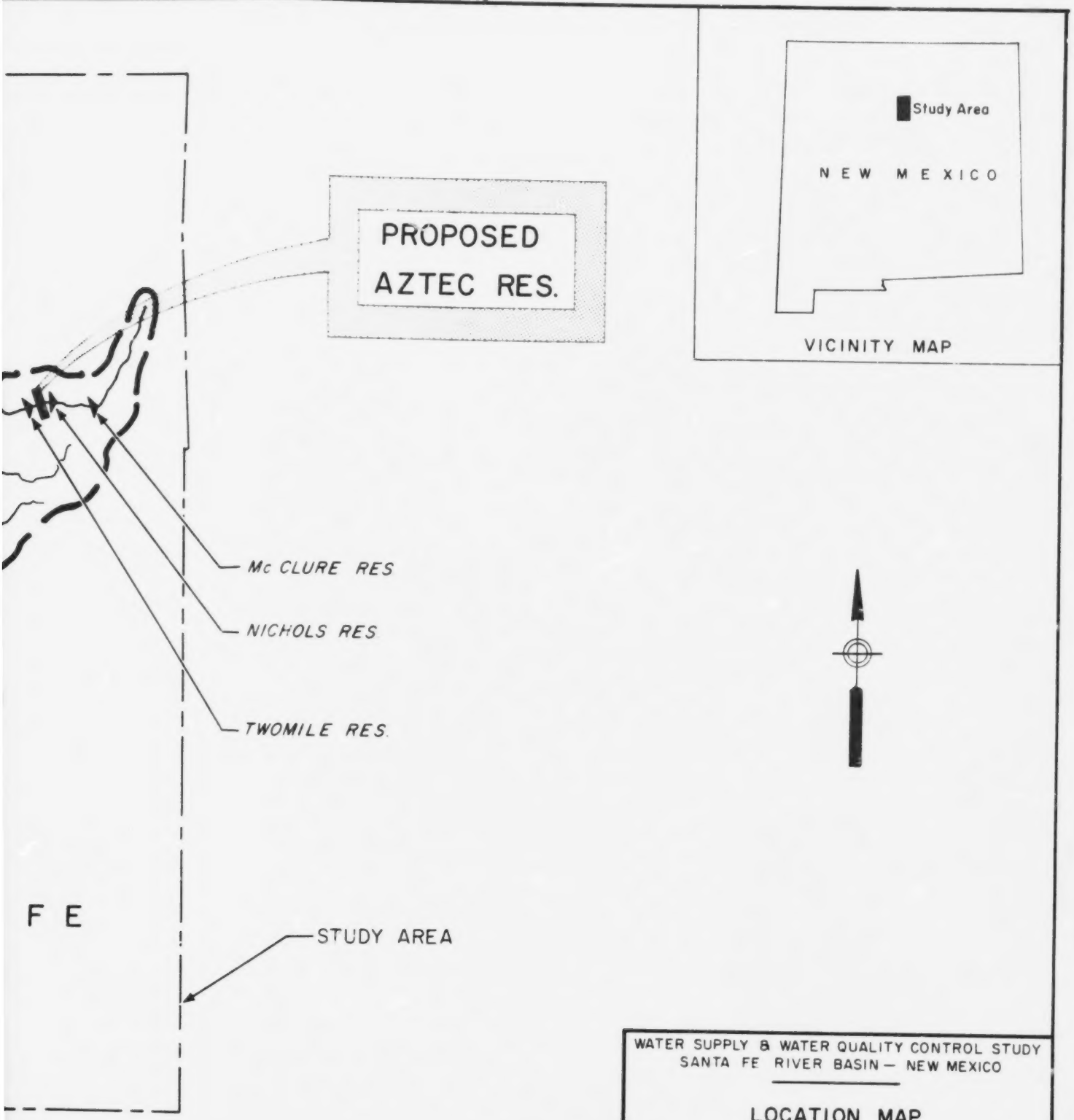

WATER SUPPLY & WATER QUALITY CONTROL STUDY
SANTA FE RIVER BASIN — NEW MEXICO

LOCATION MAP

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Public Health Service
REGION VII DALLAS, TEXAS

X-2

FIGURE III-1